PATENT SPECIFICATION (11) 1 551 044

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(21) Application No. 17126/75 (22) Filed 24 April 1975
(23) Complete Specification Filed 26 April 1976
(44) Complete Specification published 22 August 1979
(51) INT. CL.[2] B65D 7/26
(52) Index at acceptance
B8P C3B K7

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(19)

(54) COLLAPSIBLE CONTAINERS

(71) We, SEA CONTAINERS LIMITED, a British Company, of 39, Park street, London, W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to containers of the kind used for the transport of freight in so-called 'container-ships', or by rail or by road. Such containers are made to one of a few internationally agreed sizes and have caused great changes in the practice of cargo handling over the past ten years or so. Proposals have been made from time to time for collapsible containers so that when there is an imbalance of trade between two points, empty containers can be collapsed to occupy a quarter or a fifth of the height of an erect container and so fewer ships, trains or lorries are required to return empty containers than to carry revenue-earning full containers. None of the proposed collapsible containers has yet had an impact on containerized freight handling.

There are several problems which a collapsible container must overcome to be satisfactory. Firstly it must comply with the dimensional tolerances specified by the agreed international standards. It must do so both when erect and when collapsed, (or at least a stack of collapsed containers must fit the dimensions laid down for an ordinary container). Secondly a container must be robust. A rigid container must withstand a fair amount of wear and tear from handling in transit which a collapsible container must be able to withstand as well. But a collapsible container must also be robust and simple to operate during collapsing and re-erecting. Thirdly, there is the question of cost. A collapsible container is bound to cost more than a rigid one but if its costs are too much greater than those of a rigid one then it will not be worth the savings available from return journeys in the collapsed position.

According to the present invention there is provided a collapsible container having a base, a pair of end frames hinged to the base for folding inwardly onto the base, a pair of opposed one-piece side walls hinged to the base for folding inwardly on the base into a collapsed position, a detachable roof member supported on the upper portions of the walls when the latter are erect, and a stub corner post fixed vertically at each of four corners of the base, the top of each stub corner post being terminated in a bearing surface for supporting a corner post of the corresponding end frame of the container when the end frame is erect, the area of the roof member in plan being less than that of the base whereby the roof member may be positioned within the stub corner posts for stowage, and the remainder of the container roof being formed by upper portions of at least the end frames of the container.

An embodiment of the present invention will now be described in detail, by way of example, with reference to the accompanying drawings in which:—

Figures 1 to 6 are a perspective sketches showing six steps in collapsing a container;

Figure 7 is a cross-section through a collapsed container;

Figure 8 is an elevation of a catch for holding down a container lid;

Figure 9 is a perspective cut-away view of a stub corner post looking out from inside the container;

Figure 10 is a diagram of constraints in positioning a hinge on a stub corner post; and

Figure 11 is a perspective view of a fixing element.

Figure 12 is a view of the underside of a side post of an end wall of the container,

Figure 13 is a fragmentary section on the line XIII—XIII of Figure 12 on an enlarged scale,

Figure 14 shows a top corner and a bottom corner of one of the sides of the container in elevation,

Figure 15 is a vertical cross-section on the

line XV—XV of Figure 14.

Figure 16 shows how a top corner of a side wall is detachably secured to an end wall,

Figure 16a is a horizontal Section on the line XVIa – XVIa of Figure 16 and

Figure 17 shows a stack of four collapsed containers.

The container 20 shown in the drawings has a base 50, a roof 30, side walls 40 and 42 and end walls 62 and 72, the end wall 62 having doors 60, 61 providing access for loading and unloading the container when erect. The side walls 40 and 42, and the end walls 62 and 72 are all hinged to the base 50 to enable them to be folded inwards about horizontal axes.

Before describing the components of the container in greater detail, the sequence of operations involved in collapsing the container will first be described.

Figures 1 to 6 show a sequence of steps for collapsing a collapsible container. In Figure 1 a container 20 is shown in its erect position. A first collapsing step is shown in Figure 2 where a roof member, or lid 30 is shown lifted off the container 20 by crane wires 22 attached to points 32 on the lid 30. The lid 30 is normally held in place by six toggle fasteners 34 described in detail below. These must be released before the lid 30 is lifted off.

Although the purpose for having a lift-off lid 30 is to ease collapsing of the container 20 it does import two incidental advantages. The container 20 may be used as a top-loading container as well as the more normal front-loading type of container and, in the event of the lid being damaged, it is a simple matter to replace it.

After lifting off the lid 30 sides 40 and 42 of the container 20 are folded down onto a base 50. The sides are hinged at six points along their bottom edges to the base 50 and are held in the erect position by catches located in the inside top corners of the container 20. Thus to fold down the sides 40 and 42 one of the doors 60 in the front end wall 62 must first be opened to allow a man inside the container to undo the catches. The sides are relatively light weight members of large surface area and once their retaining catches are undone they can be folded down simply by pushing them over. Wind resistance is sufficient to prevent any excessive speed and consequent damage. The sides 40, 42 may be folded down in either order; the first one down slopes down from its hinges onto a slightly recessed floor 52 of the base 50 while the second one down slopes up from its hinges to rest on the hinged edge of the other side.

The lid 30 is then lowered onto the folded sides 40, 42. To keep water out in the erect position the lid must overlap the ends of the container 20 as well as its sides, but in the collapsed position the lid 30 should be stored inside the collapsed "sandwich" to protect it while it is not fully supported all round its edges as it is in the erect position. To overcome this difficulty the end walls 62, 72 of the container 20 are provided with inwardly extending roof ledges 74 so that they are closer to each other at the roof level than at base level. Then by tipping the lid 20 as it is lowered (see Figure 4) it can be fitted between the end walls 62, 72 while overlapping the folded sides 40, 42.

The end walls 62, 72 are then folded inwards as shown in Figure 5. These walls are heavy relative to their surface area and need lowering into the folded position rather than just being pushed over which is all that is needed for the sides 40, 42. The front end wall 62 is held up in the erected condition by fastening 66, 67 for its doors 60, 61 which fastenings therefore serve a dual purpose while the rear end wall 72 has a special fastening 76 (partially visible in Figure 6) for holding itself up when the sides are folded down.

The base 50 has four stub-posts 54, 55, 56 and 57, one at each corner. These posts are ¼ of the height of the container 20 so that four collapsed containers can be stacked in the same space as one erect container. With suitable refinement of the design it may become possible to reduce this height to 1/5th so that five collapsed containers can be stacked, but clearly intermediate heights are not an attractive proposition because of the convenience of stacking collapsed containers in loads that occupy the volume of one erect container.

The stub-posts are equipped with standard-looking corner castings at both top and bottom ends. The bottom castings are indeed standard and need no further description but the top ones are modified. End and side holes are not necessary for these top castings, but may be included if desired, however, a top-lift fitting is required. The usual top oval hole is in this case slotted at one end to form an oval ended slot, such as 58 or 59. These slots provide an adequate purchase for handling the container in its collapsed state and the danger of a lifting device sliding out along the slot is avoided by using the fact that the opposite slot opens the other way. So long as there is a lengthwise rigid connection in the handling gear the slots are opposed and handling equipment remains engaged.

The purpose of the slots, combined with the channel section of the stub-posts is to allow supporting arms 69 and 79 of the end walls 62/72 to support the end walls, when erect, from directly underneath them. The slots also act as guides to ensure correct lateral positioning of the end walls, and the most important of all they allow the hinges of the end walls 62/72 to be nearer to the ends of the container 20 then would otherwise be possible. The importance of this feature is discussed below.

Erecting a container is simply carried out by going through the steps of Figures 1 to 6 in the reverse order. The lifting does not have to be

done by a crane, it is easy to use a fork-lift instead.

To fix the containers of a stack of collapsed containers to each other to form a rigid container-sized unit four special fastening elements or "cones" 80 are used. These devices can be slid into the slots in the tops of the stub-posts 54 to 57 by engaging a pair of grooves 86, 87 below the slots and sliding home. The cone part 88 projects upwards for engaging into the bottom fittings of the next container and has a hole 89 for locking two containers together by means of a bolt 24 provided at each corner for that purpose. The base 50 of the upper container prevents lateral sliding of the cones 80 out of their slots once two containers are joined, and further protection from longitudinal sliding may be provided by shaping the grooves 86 so that the elements 80 drop "home" when pushed fully into their slots. The cones are retained in the container 20 on short lengths of chain so that they are not lost and provided with stowage positions near the bottom of their stub-posts for use when the container is erect.

The lid 30 is made of corrugated steel sheet supported round its perimeter by edge beams of angle iron. On each of the side beams 35, 36 (Figure 7) there are two outward projections such as 38 which are clamped down the sides when the container 20 is erect by means of one of the toggle fasteners 34. These fasteners (see Figure 8) consist of a tongue 33 which slides into a recess in the bottom of the projection 38 and a loop 39 which is placed over the projection 38 and then pulled down to a clamped position by a lever 31. Various arrangements can be made to lock the lever 31 in the clamped position and the practice of customs officers for sealing containers with bonded goods should be taken into account.

Weather sealing is provided by tubes of neoprene 48 extending along the inside edges of the side beams 35/36 and also along similarly extending end beams.

The sides 40/42 are also made of corrugated steel sheet and each has a bottom beam 44 of box section and a top beam 45 of angle section. The box section beams 44 are hinged to edges of the base 50 which are raised above the floor 52 by about the thickness of the sides 40/42. This is to allow the sides to be folded down in either order since the first side to be folded rests on the floor 52 below the hinge of the other side (see Figure 7).

Along the bottom edge (in the erect position) of each of the box section beams 44 there runs a tube 46 of neoprene which is pressed against a sill 51 of the base 50 to provide a water-tight seal.

The main problem with the end walls is the location of the hinge axis about which they rotate. Both in the collapsed position and in the erect position the container must fit within the laid-down dimensions. This causes two constraints. Firstly the front edge of the end wall must lie either in the front plane of a container (when erect) or in a plane level with or below the top of the stub-posts (when collapsed). This means the hinge axis must be on or below a 45° line drawn from the outside top edge of the stub-post. Secondly the bottom edge of the end wall must not stick out beyond the end of the base 50 when the wall is folded down so the hinge axis must lie below a 45° line drawn up from the front edge of end sills 53 of the base 50.

This is illustrated in Figure 10. Other desirable constraints on the hinge position are that it should be as close to the ends as possible to keep it out of the way of the sides when they fold and as high as possible to keep the supporting arms 69, 79 as short, and hence as strong, as possible.

The balance chosen in the limits allowable has been to raise the end sills 53 (causing the floor 52 to be in a well with edges all round) thereby raising and bringing forward the highest available hinge axis. With the axis so far forward the supporting arms 68 etc. have to go through part of the stub-posts when the container is erect. Some small further advantage can be achieved by moving the effective outside top corner of the stub-post back a little into the container, the effective point being where the bottom outside edge of the end wall meets the stub-post in the erect position.

As can be seen in Figure 9 the hinge 90 on the stub-post 57 consists of two triangular members 91, 92 with a simple pin 93 passed through them. There is a flange 95 connected to the stub-post 57 making up part of the side wall of the container and this is continued with a flange 96 all the way up a corner post 97 of the front end wall 62. The other three corners are of similar construction.

The edges of the sides 40/42 and the lid 20 all have to be sealed against bad weather and sea water. This is done by means of neoprene tubing such as the tubes 46 which are compressed on erection of the container or by the tubes 48 which are compressed by the top edges of the top beams 45. Sealing tubes are provided along the vertical edges of the sides and the ends of the lid. A corner piece 98 is provided behind each of the stub-posts to ease transition between a bottom seal to a side seal.

While the embodiment described is indeed made of steel with neoprene tubing for sealing purposes, it will be appreciated that collapsible containers can also be built of other materials. Similarly the preferred quantities of catches and hinges for the sides etc. is a matter of design choice and may be varied to suit prevailing requirements.

Figures 12 to 15 show sealing arrangements for preventing the ingress of water into the erect container and for collecting and removing any water which enters past the seals, for example as the result of minor damage to the

latter.

Figures 12 and 13 show the sealing arrangement between the undersurface 101 of a corner post 97 and the top surface of its stub corner post 57. The surface 101 is formed with a wide and shallow groove 102 along two sides of the surface adjacent the outer sides of the corner post. The groove 102 accommodates a sealing member 103 of neoprene which as seen in section in Figure 13 has a hollow circular position 104 and a flat flange 105 clamped between aluminium alloy strips 106 and the top wall of the groove 102 by means of pop-rivets 107 engaged in blind bores 108.

As can be seeen in Figure 13, the circular section 103 projects below the face 101 and is therefore compressed when the face 101 comes into load bearing contact with the top surface of the stub corner post 57. The sealing member is continued in the direction towards the corresponding side wall 40 or 42 by a portion 109 which makes sealing contact with a block 110 (Figure 9).

In the case of the end wall 72, the sealing member extends from one corner post along the underside of the end wall to the other corner post where it becomes integral with the sealing member of the other corner post. In between the two corner posts, it is secured to the underside of the end wall by further aluminium and pop-rivets.

Figures 14 and 15 show the preferred method of effecting a seal between the side walls 40 and 42 and both the base 50 and the corner post flanges 96. A continuous length of neoprene gasket 111 is a similar construction to that shown in Figure 13 with the exception that its tubular portion (Figure 15) is of somewhat flattened cross-section and is preferably corrugated at its sealing surface. The flange 112 of the strip is clamped against the outer surface of its side wall by aluminium strips which are either straight as shown at 112 or form quadrants of a circle as shown at 113. The bottom run of the sealing member 111 is compressed against an upper reinforced portion 114 of the container base which portion is continued downwards below the seal 111 to form a drip-collecting channel 115 which extends the full length of the container base between the two stub posts 57 which are formed with drain holes 116 which allow any liquid collected in the channel 115 to escape downwards through the stub posts.

The quadrant-shaped portions of the sealing member 111 seal against flat inner surfaces of the stub post flanges 95 while its vertical runs seal against the inner surfaces of the flanges 96.

Figures 16 and 16a shows the connection which is made at one end of the top of the side wall 42 to the adjacent end wall, in this case 72. There, the flange 96 of the corner post 97 carries a substantial peg 121 which passes through an eye in a substantial tab 122 welded into the upright end member 123 of the side wall 42. A cotter 124 has a tapered profile and is tapped home into a correspondingly shaped cross bore 125 in the peg 121 to lock the side and end walls together. In the collapsed condition, the cotter 124 can be engaged on a hook 126.

Figure 17 shows a stack of four of the containers super-imposed on each other in the collapsed condition. Each container base 50 has a pair of laterally extending channels 131 to receive the lifting fork of a 20 or 25 ton fork lift truck. In the collapsed condition, each base 50 has sufficient resilient flexibility to ensure that when the lifting fork of a fork lift truck is engaged in the channels 131 of the lowermost container base 50 to lift the stack of four collapsed containers connected by their fastening elements, a major part of the lifting forces are transmitted to the superimposed base 50 through the top corner castings 133 of the corner posts 97 of the end walls 70 and 72, these corner castings engaging the underside of the superimposed container. However, when the lowermost container base 50 is resting on level ground, there is a clearance between the corner castings 133 and the superimposed container base.

Features of the container form the subject of our copending application No. 7901114. (Serial No. 1551045)

WHAT WE CLAIM IS:—

1. A collapsible container having a base, a pair of end frames hinged to the base for folding inwardly onto the base, a pair of opposed one-piece side walls hinged to the base for folding inwardly on the base into a collapsed position, a detachable roof member supported on the upper portions of the walls when the latter are erect, and a stub corner post fixed vertically at each of four corners of the base, the top of each stub corner post being terminated in a bearing surface for supporting a corner post of the corresponding end frame of the container when the end frame is erect, the area of the roof member in plan being less than that of the base whereby the roof member may be positioned within the stub corner posts for stowage, and the remainder of the container roof being formed by upper portions of at least the end frames of the container.

2. A collapsible container according to claim 1, wherein each corner post it hinged to its stub corner post about an axis displaced from the stub corner post towards the interior of the container to thereby hinge the corresponding wall to the base.

3. A collapsible container according to claim 2, wherein the bearing surface at the top of each stub corner post has a slot extending around into a side of the stub corner post facing the interior of the container, the slot being shaped to perform two functions; the first being to act as a top-lift anchorage to permit the handling of the container in the

collapsed position by standard container-handling equipment, and the second function being to so accommodate an arm connecting the corner post to its hinge that in the erect position the corner posts standing on the stub corner posts which extend the stub corner posts to the full height of the container are positively positioned over the stub corner posts by the arms being engaged in their corresponding slots.

4. A container according to any of the preceding claims including fastening elements for aligning one collapsed container with another stacked on top of it.

5. A container according to claim 3 and 4, wherein the fastening elements are arranged for a sliding fit into the slots of the stub posts while the end walls are folded down so that their arms are not guided through the slots.

6. A container according to claim 5, wherein the fastening elements are arranged to lock into the slots by dropping down after sliding fully home and in operation to engage the bottom corner fittings of the container stacked above.

7. A container according to claim 6, wherein a hole is provided through the fastening elements so that a locking pin can be used to lock the containers together so that the container handling machinery can handle a stack of collapsed containers safely by engaging only the top or the bottom container of the stack.

8. A container according to any of the preceding claims, wherein the roof member is dimensioned for storage either way round in the collpased condition of the container.

9. A container according to any of the preceding claims, wherein the side walls was so arranged that they can be folded down in either order.

10. A collapsible container according to any of the preceding claims and including sealing means between the side walls and the base, between the side walls and the stub posts, between the corner posts and the stub posts, between the side walls and the corner posts and between the end walls and the base.

11. A collapsible container according to claim 11, wherein the sealing means between the side walls and the other components comprise a resilient sealing strip having a horizontal bottom run connected by two corner portions to vertical runs at either end of the said wall.

12. A collapsible container according to claim 10 or 11, wherein the sealing means between each corner post and its stub corner post are located in a groove in the underside of the corner post.

13. A collapsible container according to claim 12, wherein the sealing means of two corner posts of one end are integral with the sealing means between that end and the base.

14. A collapsible container according to any of the preceding claims, wherein the height of the stub corner posts is such that when a second container is superimposed on the collapsed container, the weight of the second container is carried solely by the stub corner posts of the first container.

15. A collapsible container according to claim 14, wherein the container base has lifting points intermediate its ends and the container base is sufficiently flexible to ensure that when a stack of four identical collapsed containers is lifted by the lifting points of the lowest, part of the weight of the superimposed containers are transmitted to the lowest container by contact between top edge portions of folded walls of the lowest container being abutted by the base of the next super-imposed container.

16. A collapsible container substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by MULTIPLEX techniques ltd., St. Mary Cray, Kent. 1979. Published at the Patent Office, 25 Southampton Buildings, London WC2 1AY, from which copies may be obtained.

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Sheet 1

FIG. 1

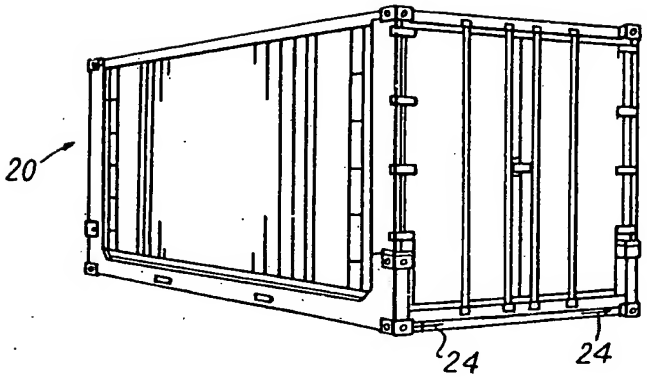


FIG. 2

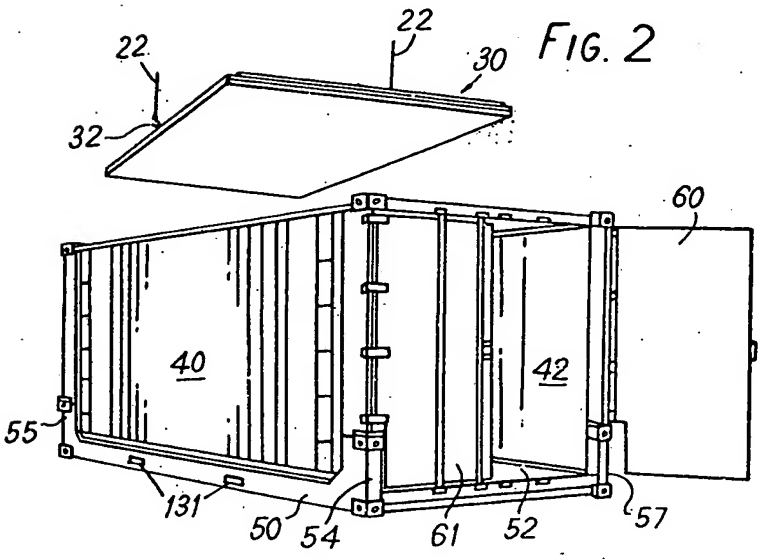


FIG. 3

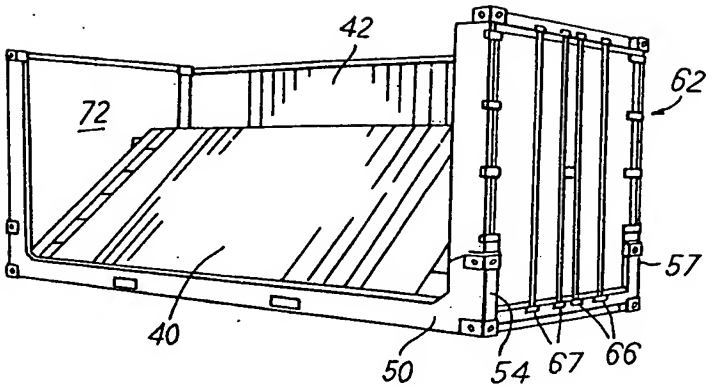
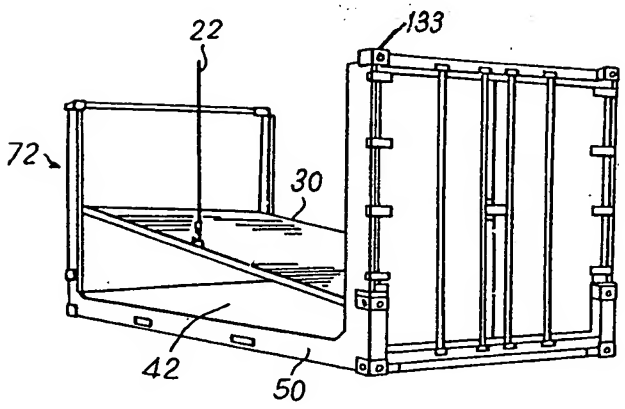


FIG. 4



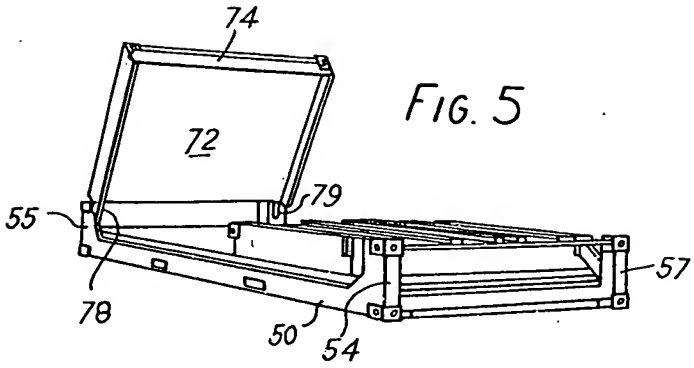

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FIG. 5

FIG. 6

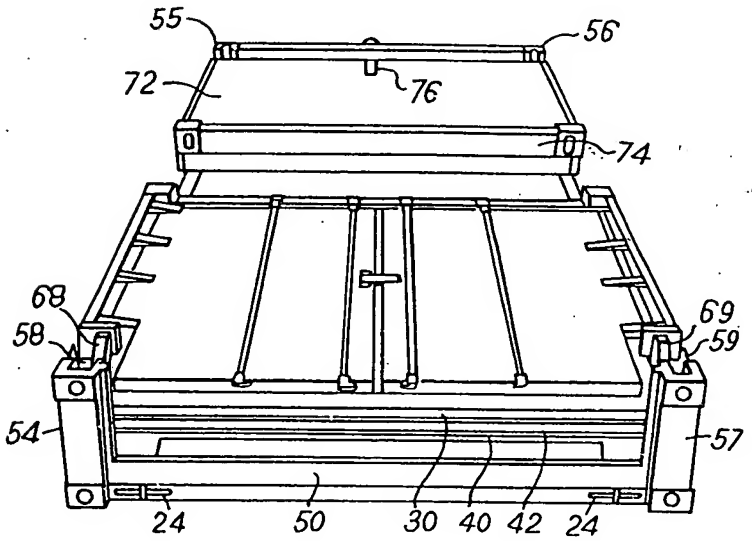
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FIG. 7

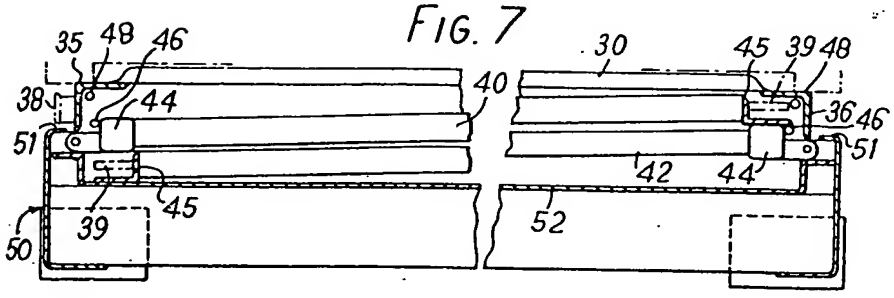
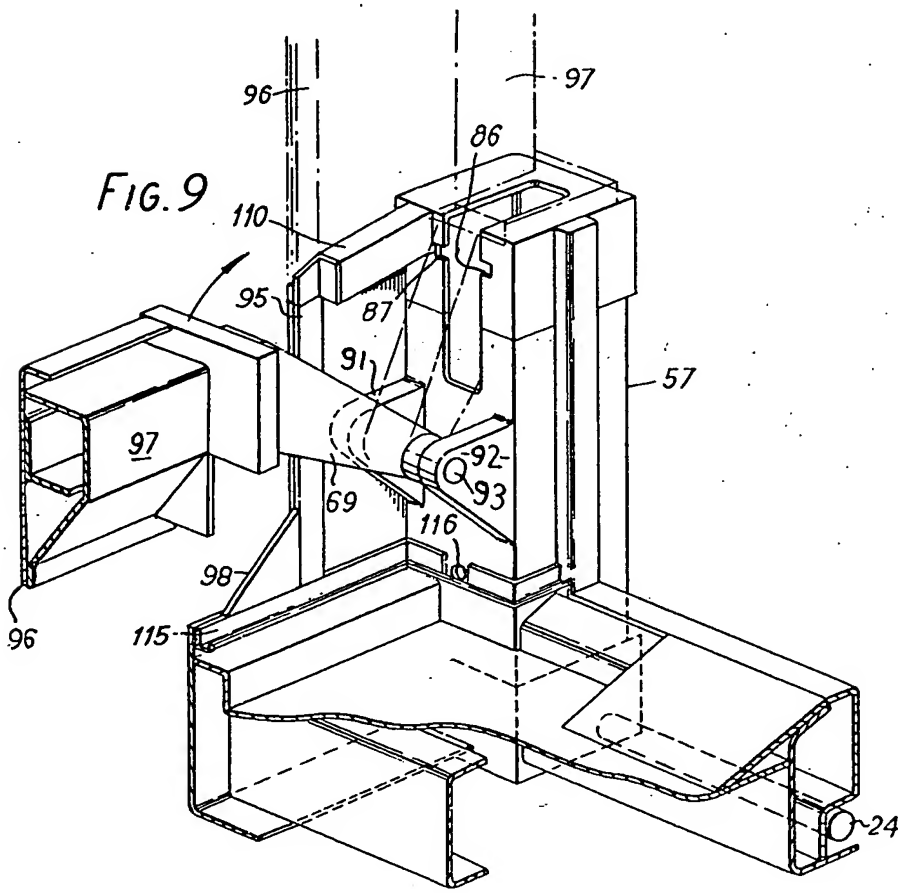


FIG. 9



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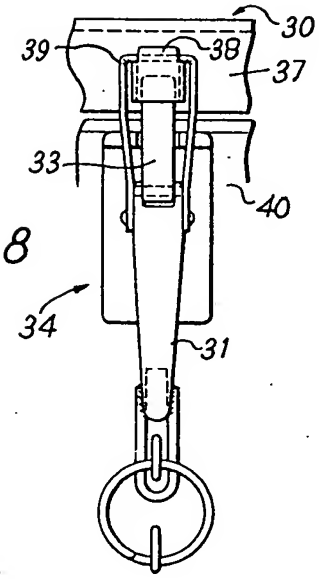


FIG. 8

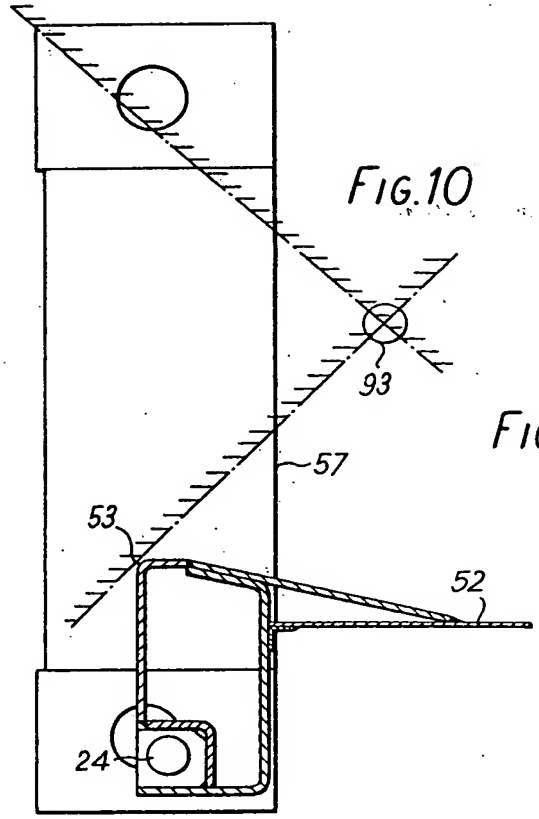


FIG. 10

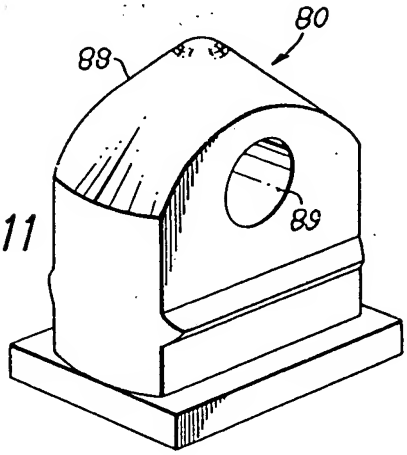


FIG. 11

FIG.12

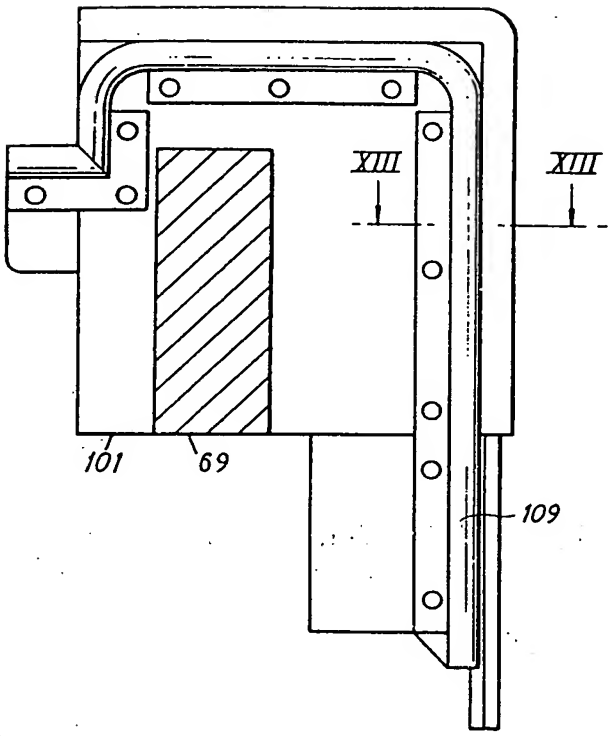
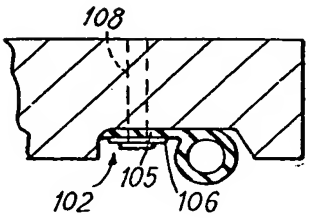


FIG.13



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Sheet 7

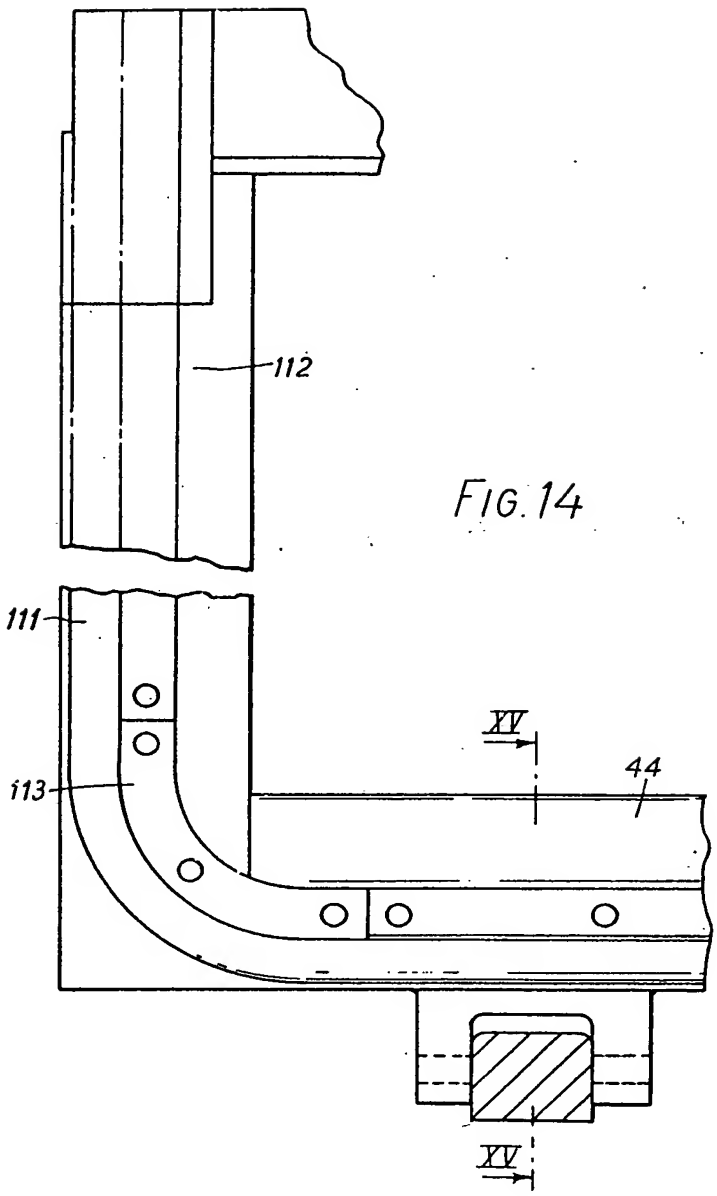

FIG. 14

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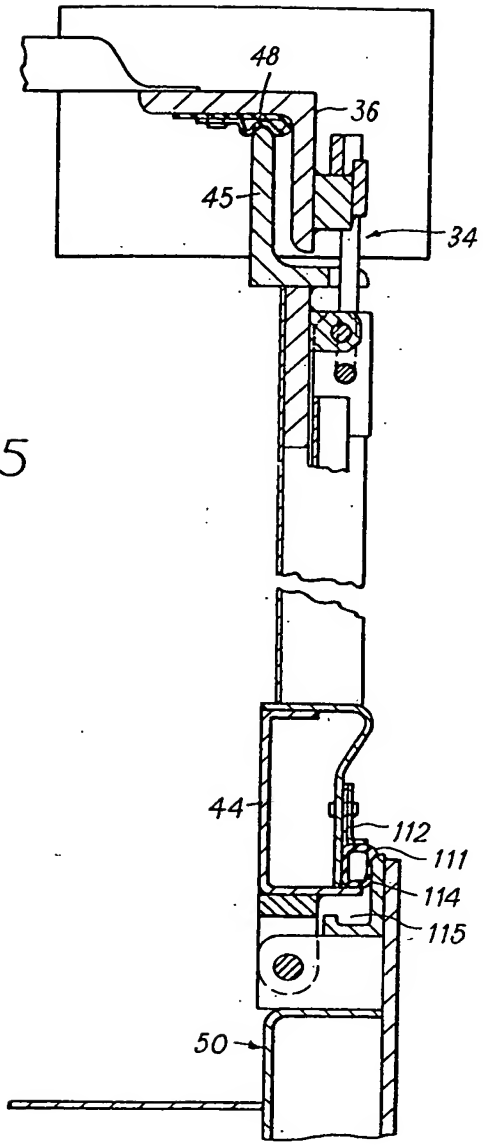

FIG. 15

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FIG. 16

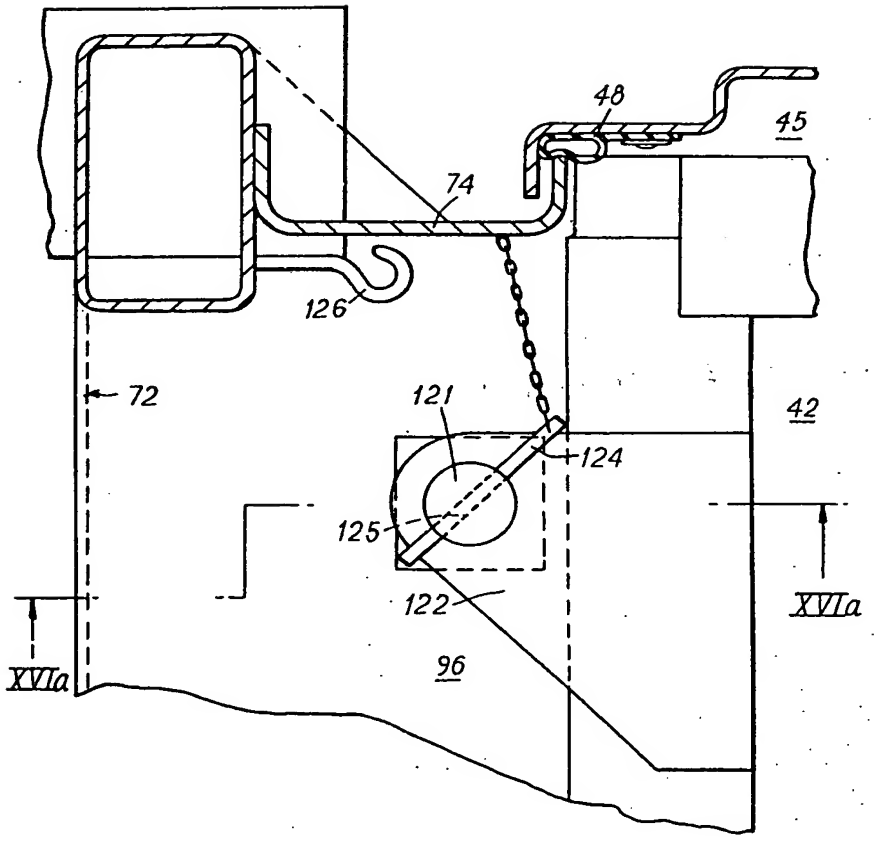

FIG. 16a

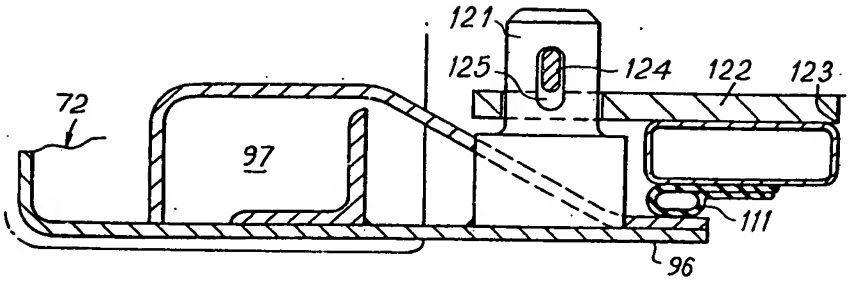

FIG. 17